

## L2-(3.2) Characteristics of Quadratic Relations

Key Concepts:

- vertex
- zeroes
- where are they?
- how many? 0, 1, or 2
  - axis of symmetry
  - direction of opening
  - optimal value
- maximum or minimum?

The vertex is the highest or lowest point on the parabola, and we refer to its coordinates as  $(h, k)$ .

The axis of symmetry is the vertical line passing through the vertex, having the equation  $x = h$ .

If the parabola opens up, the coefficient of  $x^2$  is positive:

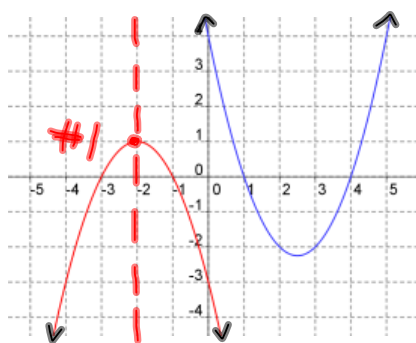
- the vertex is the lowest point
- the minimum (or optimum) value is  $k$

If the parabola opens down, the coefficient of  $x^2$  is negative:

- the vertex is the highest point
- the maximum (or optimum) value is  $k$

Ex.1. Consider the two graphs:

Can you deduce values for each of the following?

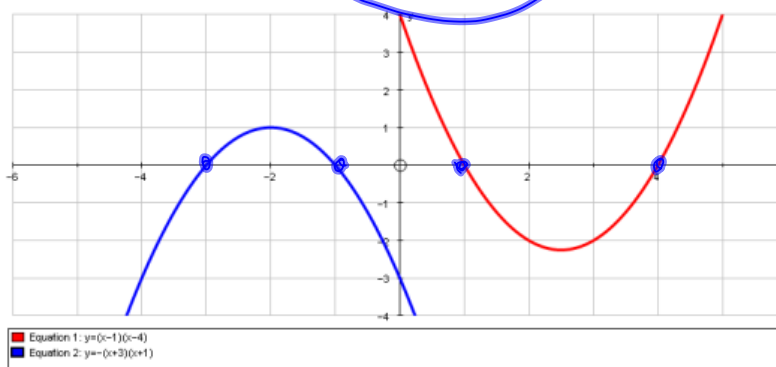


Property	#1 $y = -x^2 - 4x - 3$	$y = x^2 - 5x + 4$
Direction of Opening	Down	Up
Maximum or Minimum	Max	min
Number of Zeroes	2	2
Axis of Symmetry	$x = -2$	$x = 2.5$
Location of Vertex	$(-2, 1)$	$(2.5, -2.25)$
Location of Zeroes	-3 and -1	1 and 4
y-intercept	$(0, -3)$ or -3	4

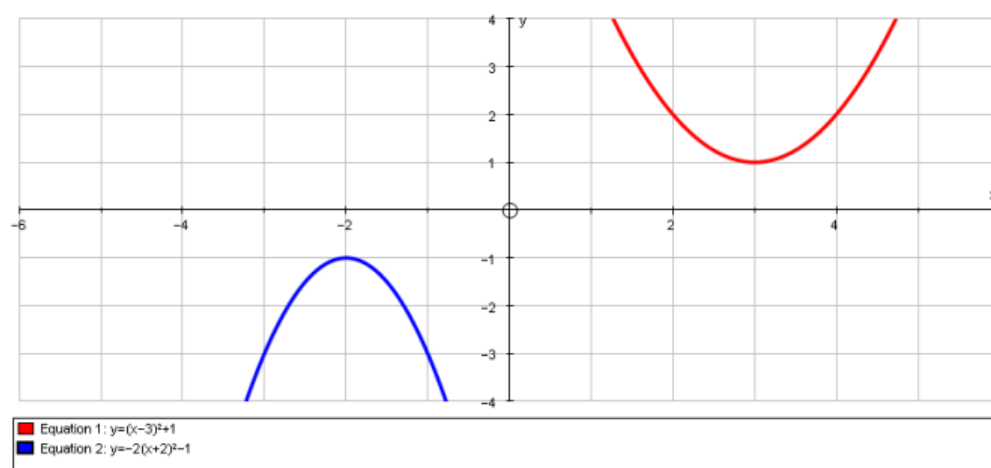
#1 zeroes  
 $(-3, 0)$   
 $(-1, 0)$

If the parabola crosses the x-axis, the x-coordinates of the crossing points are called the zeroes, or roots, or x-intercepts. Same

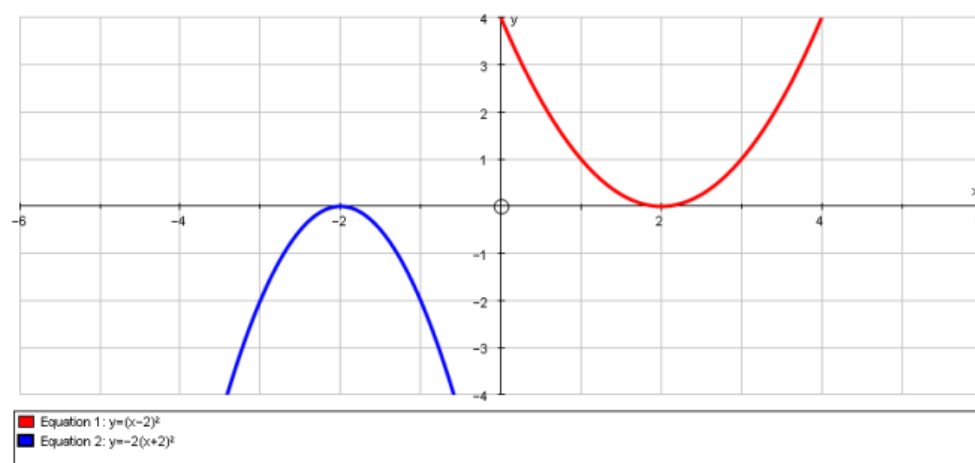
A parabola may have two zeros:



Or no zeroes:



Or one zero:

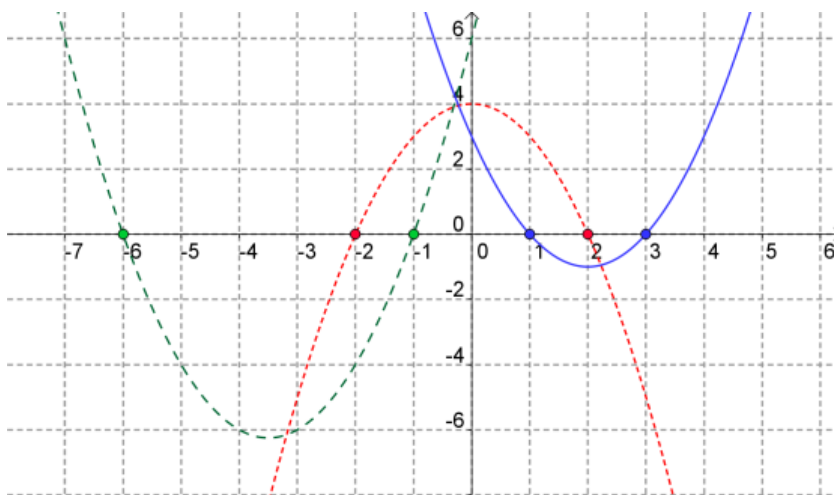


Ex.2. From your graphs, determine key features of each.

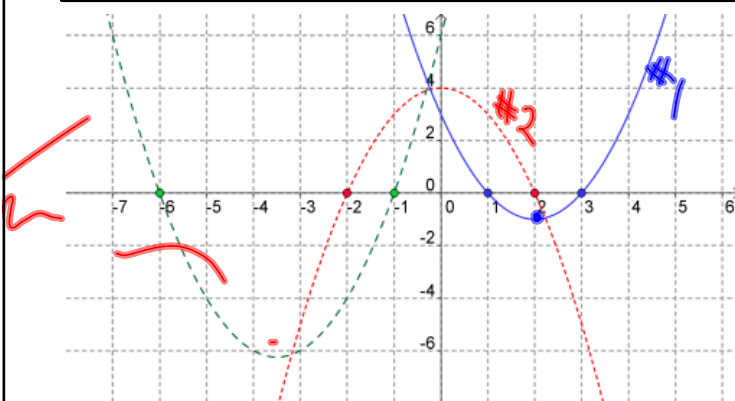
$$y = x^2 - 4x + 3$$

$$y = -x^2 + 4$$

$$y = x^2 + 7x + 6$$



	<sup>#1</sup> $y = x^2 - 4x + 3$	<sup>#2</sup> $y = -x^2 + 4$	$y = x^2 + 7x + 6$
optimal value	-1	4	-6.25
vertex	(2, -1)	(0, 4)	(-3.5, -6.25)
opening	up	down	up
max/min?	min	Max	min
max/min value	-1	4	-6.25
y-intercept	3	4	6
zeroes	1 and 3	-2 and 2	-6 and -1
axis of symmetry	$x = 2$	0	$x = -3.5$



Assigned Work:

p. 145 # 1-6, 7ef, 9ab